Short Communications

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Bald Eagle Reproductive Performance Following Video Camera Placement

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Bald Eagle (*Haliaeetus leucocephalus*) nesting behavior is difficult to quantify because of the sensitivity of adult eagles to human activity and their habit of nesting in supercanopy trees often not visible from the forest floor. Time-lapse movie cameras have been utilized in at least two studies of nesting Bald Eagles. Cameras were placed at three nests in northern California when nestlings were 4–6 wk old (Jenkins 1989) with no adverse effects on adult behavior or reproduction. However, cameras placed at nests during incubation and the first two weeks post-hatch caused a high rate of nest abandonment at nests in southeast Alaska (Cain 1985). Both studies also employed repeated visits to the nest site to change film and batteries. To minimize this type of disturbance, we located video recorders 200–400 m from Bald Eagle nest trees and mounted cameras remotely at nests to quantify adult and nestling behavior (Dykstra et al. 1998, 2001, Warnke et al. 2002). As a test of our hypothesis that this technique would not decrease Bald Eagle reproductive success, we documented eagle reproductive performance following camera placement and compared it with the average reproductive performance of a healthy, rapidly expanding population in northern Wisconsin.

Methods

Study Areas. Bald Eagle nests studied were clustered primarily in three regions in northern Wisconsin: inland Wisconsin, along the Lake Superior shore, and along the Lake Michigan shore. Northern Wisconsin inland nests were located along the shores of natural lakes, reservoirs, or large rivers in Iron, Oneida, and Vilas counties, Wisconsin. Lake Superior nests studied were <8 km from the Lake Superior shore in Iron, Ashland, Bayfield, and Douglas counties, Wisconsin. Lake Michigan nests studied were <8 km from the Lake Michigan shore in Oconto and Marinette counties, Wisconsin. A single nest was studied in central Wisconsin (Adams county) along the Wisconsin River Study areas were described by Warnke et al. (2002). Cameras were placed at selected nests located in all study areas ("camera nests" hereafter). For comparison, we measured reproduction at all 1992–94 nests not disturbed by camera placement in Vilas and Oneida counties ("undisturbed nests" hereafter). Human activity (primarily hikers, boats, airplanes, and automobiles) differed from nest to nest, but was generally low at Lake Superior nests (camera nests) and moderate at northern Wisconsin inland nests (camera and undisturbed nests) and Lake Michigan nests (camera nests).

Video Cameras. Video cameras (four Sony model M-350 and two Sony model M-332) were mounted adjacent to or in the nest tree above nests between November and early February at 17 nests from 1992–96. The timing of camera placement was selected to coincide with the period that eagles were least likely to be on their territories, because most northern Wisconsin pairs migrate south in winter. Video cameras were also mounted at three nests during the summer prior to our experiment and left in place over winter for the spring breeding season (1994–98).

Cameras were placed in trees ≤15 m from the nest and

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Table 1. Reproductive performance of Bald Eagles at nests where video cameras were placed and at undisturbed nests in northern Wisconsin, 1992–98.

NEST TREATMENT	YOUNG PER BREEDING ATTEMPT (N)		YOUNG PER SUCCESSFUL NEST (N)		NEST SUCCESS[1] (PERCENT)
Camera nests	1.28	(18)	1.77	(13)	72
Undisturbed nests	1.26	(362)	1.68	(271)	75

[1] Percent of breeding attempts that were successful.

ca. 1–3 m above the level of the nest bowl or 1.1–2.0 m above the nest in the nest tree. Cameras were camouflaged by fixing natural or artificial vegetation such as spruce (*Picea* spp.), northern white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and pine (*Pinus* spp.) boughs to 2.5-cm mesh chicken fencing and fastening this around the camera and its mounting plate. Coaxial cable (RG-8UM type) connected cameras to the video recorders, which were located 200–400 m from the nest tree, out of the line-of-sight from the nest tree. Time-lapse video recorders (two Sony® EVT-820 Fieldcams and one Fuhrman WCMS-4/V11) were used to record nest behaviors. Video tapes were replaced about once per week at nests containing eggs or nestlings. Researcher activity in the vicinity of the nest during the breeding season consisted primarily of weekly visits to the recorder to change batteries and tapes. For details, see Warnke et al. (2002).

Reproductive Success. Reproductive outcomes at camera nests were determined by observing video recordings from each nest throughout the breeding season. Nests were considered to be breeding attempts if eggs were laid (Steenhof 1987) and were considered successful if at least one nestling was raised to fledging age. Nests were considered unoccupied if no eggs were laid, and failures if eggs were laid but no nestlings were fledged.

Reproduction at undisturbed nests was assessed during 1992–95 by the Wisconsin Department of Natural Resources (WDNR) by inspecting nests from the air twice during the breeding season, once during incubation, and again when nestlings were 4–7 wk old. In the first aerial survey, nests where the eagle pairs were incubating eggs were counted (defined as a "breeding attempt" by Steenhof [1987]), and in the second survey, the nestlings were counted.

We compared reproductive outcomes at camera nests to that at undisturbed nests. Eagle productivity for all nests was calculated in two ways: (1) by dividing the total number of young produced by the total number of territories where birds attempted breeding and (2) by dividing the total number of young produced by the total number of successful territories. Nest success was determined as the proportion of breeding attempts producing ≥1 young.

RESULTS

Video cameras were placed in or adjacent to nest trees within 20 Bald Eagle territories in northern Wisconsin from 1992–98. Eagles at 13 of these territories (65%) nested in the tree where the cameras were placed, eagles at five of these territories (25%) nested at alternate nests within the territory, and two territories were not occupied (10%). Nesting was successful at 13 of 18 territories where breeding attempts occurred (72%; Table 1); nine of 13 nest attempts were successful when eagles nested in trees where cameras were placed (69%), while four of five attempts were successful at alternate nests (80%). Twenty-six young hatched at the 18 territories where breeding attempts occurred (1.44 nestlings hatched/breeding attempt) and 23 young fledged (1.28 fledglings/breeding attempt; Table 1); one nestling was killed by its older sibling at about 1 wk of age at an inland nest and two nestlings were killed by a mammalian predator at 6 wk of age near Lake Superior.

Camera nests and undisturbed nests did not differ in any measure of productivity (Table 1). The reproductive success of eagles at undisturbed nests averaged 1.26 ± 0.05 young/breeding attempt (N = 362, t = 0.08, P = 0.93) and 1.68 ± 0.04 young/successful nest (N = 271, t = 0.53, P = 0.60; Table 1).

DISCUSSION

Our results indicated that video cameras can be used to document adult and nestling Bald Eagles' behaviors without causing a decrease in productivity. In other studies, a productivity rate >0.8–1.0 young/occupied territory has been associated with healthy, expanding Bald Eagle populations (Buehler et al. 1991, Best et al. 1994, Bowman et al. 1995). Productivity at undisturbed nests in northern Wisconsin averaged 1.26 young/breeding attempt in 1992–94, or 1.1 young/occupied territory (measured 1994–95), similar to the reproductive success observed at camera nests. Comparison of reproductive performance at camera nests (1.28 young/breeding attempt) to that indicative of healthy populations (>0.8–1.0 young/occupied territory) is complicated by the use of slightly different reproductive measurements, but other investigations have shown that the number of young/occupied territory is about 10% lower than the number of young/breeding attempt in this region (Dykstra 1995) Thus, the reproductive rate at both camera nests and undisturbed nests was likely greater than that associated with healthy, expanding populations.

Two factors may have contributed to the low impact of video cameras used in this study. First, at territories where cameras were mounted in winter, great care was taken to mount cameras when eagles were not present on the territory; this was only possible because all pairs we studied were migratory. Second, the location of the recorder, 200–400 m from the nest tree, ensured that eagles were not disturbed when tapes were changed and batteries were replaced. If coaxial cable was damaged (by fallen trees or by animals' chewing) within sight of the nest tree, repair was not undertaken until chicks were banded at 4–6 wk of age (two territories). Although this decision resulted in some lost data, it reflected our primary goal of minimizing impact on nesting eagles during incubation and the early nestling period.

Because some pairs nested at alternate nests within their territories, not all cameras placed in winter can be expected to provide useful information. Breeding attempts at the camera nests can be expected at ca. two-thirds of territories. The use of alternate nests in this study was probably not due to the presence of the cameras, as the frequency of switching to another nest (5 of 18 breeding attempts, 27.8%) was the same as that of an undisturbed, neighboring population of eagles in the western Upper Peninsula of Michigan ($\bar{x}$ = 30 9% annual frequency of switching to an alternate nest, 1991–93; S. Postupalsky unpubl. data) and was only slightly higher than that of inland Wisconsin eagles in the north-central region of the state (18.5% annual switch frequency, 1992–95). In addition, the nest-switching had no impact on overall productivity. Northern Wisconsin provides excellent Bald Eagle habitat, and many eagle pairs in this region have five or more alternate nests. Where alternate nests are not available in areas of marginal habitat, camera placement could be more disruptive to reproduction.

RESUMEN.—El comportamiento de anidación del águila calva (*Haliaeetus leucocephalus*) es difícil de monitorear debido a que las águilas adultas son muy sensibles a la actividad humana. Registramos el comportamiento de anidación usando video cámaras montadas cerca de los nidos y grabadores temporizados localizados 200–400 m de los nidos. Las cámaras de video fueron colocadas cerca de 20 nidos del norte de Wisconsin durante el invierno cuando las águilas estaban ausentes de sus territorios o durante el verano anterior. Para evaluar el impacto de las cámaras y de la actividad humana asociada, documentamos el desempeño reproductivo mediante cámaras emplazadas y comparamos estas con el desempeño reproductivo promedio de águilas no perturbadas del norte de Wisconsin. El éxito reproductivo en los nidos con cámaras no difirió de los nidos imperturbados (1.28 vs. 1.26 juveniles/intento reproductivo y 1.77 vs. 1.68 juvenil/nido exitoso, respectivamente). Similarmente, la anidación exitosa no difirió (72% vs. 75% de los intentos reproductivos fueron exitosos en los nidos con cámaras y en los nidos sin perturbación respectivamente). Concluimos que las cámaras de video pueden ser usadas exitosamente para documentar el comportamiento de anidación del águila calva sin causar detrimento en la productividad.

[Traducción de César Márquez]

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ABSENCE OF BLOOD PARASITES IN NESTLINGS OF THE ELEONORA'S FALCON (*FALCO ELEONORAE*)

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Parasites are an important factor influencing the dynamics of populations and the structure of animal communities (Sheldon and Verhulst 1996). In birds, haematozoan parasites have been found in more than 2500 of 4000 species examined (Bennett et al. 1992, Bishop and Bennett 1992). The order Falconiformes includes ca. 285 species (Peirce et al. 1990). No haemoproteids have been described for the families Cathartidae (75 species), Pandionidae (15 species), and Sagittaridae (15 species), but four species of haemoproteids have been described from the family Falconidae (59 species). The Eleonora's Falcon (*Falco eleonorae*) is a migratory falcon that nests on islands of the Mediterranean region and winters in southeast Africa, mainly in Madagascar and the Mascarene islands (Walter 1979).

In this study, we examined blood smears of 42 nestlings of the Eleonora's Falcon (18 in 1999 and 24 in 2000) to detect the presence of blood parasites. The only published works on the prevalence of blood parasites in Eleonora's Falcon are those by Wink et al. (1979) and Ristow and Wink (1985), who reported a low prevalence (13%) of *Leucocytozoon toddi* in adult birds (2 of 16 birds infected), but no information for nestlings was provided. To our knowledge, our work is the first to report on blood parasites in nestlings of the Eleonora's Falcon.

Nestlings sampled came from the Columbretes archipelago, a small (19 ha) volcanic outcrop located 63 km off the coast of Castellón (39°54'N, 0°41'E) where about 30 pairs of Eleonora's Falcon breed (A. Martínez-Abraín unpubl. data). Vegetation is typical of a Mediterranean island with small shrubs and annual plants. The only sources of fresh water are two cisterns which collect water from the scarce rainfall (annual mean ca. 250 mm). All 1999 samples came from the main group of islands (Columbrete Gran and Mancolibre), but in 2000 we included samples from Foradada and Ferrera islands. Nestlings sampled came from eight different nests in 1999 and from 16 in 2000. Blood samples were collected by venipuncture of the ulnar vein of 20–25-d-old chicks from 17–22 September 1999 and from 21–23 September 2000. Smears were air-dried and fixed in methanol on the day of sampling. In the laboratory, slides were stained with Giemsa and examined under a microscope with oil at 1000×, using the techniques of Korpimäki et al. (1995). Prevalence was established through the inspection of 100 fields, containing about 100 erythrocytes each. All smears were inspected twice by the same person (A. Martínez-Abraín) and once by a second observer (B. Esparza) at lower power (400×). We sampled haematophagous night-dwelling insects in September 2000, with a Center for Disease Control (Kimsey and Chaniotis 1984) mosquito trap placed for three consecutive nights on the main island but no haematophagous insect was trapped.

No blood parasites were found in the 42 blood samples taken from Eleonora's Falcon nestlings. Because the Eleonora's Falcon is an island species and marine habitats seem to represent an unsuitable environment for po-

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